National Institute of Environmental Health Sciences

Hidden shift of the ionome of plants exposed to elevated CO2 depletes minerals at the base of human nutrition

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Abstract:

Mineral malnutrition stemming from undiversified plant-based diets is a top global challenge. In C3 plants (e.g. rice, wheat), elevated concentrations of atmospheric carbon dioxide (eCO2) reduce protein and nitrogen concentrations, and can increase the total nonstructural carbohydrates (TNC; mainly starch, sugars). However, contradictory findings have obscured the effect of eCO2 on the ionome - the mineral and trace-element composition - of plants. Consequently, CO2-induced shifts in plant quality have been ignored in the estimation of the impact of global change on humans. This study shows that eCO2 reduces the overall mineral concentrations (-8%, 95% confidence interval: -9.1 to -6.9, p<0.00001) and increases TNC:minerals > carbon:minerals in C3 plants. The meta-analysis of 7,761 observations, including 2,264 observations at state of the art FACE centers, covers 130 species/cultivars. The attained statistical power reveals that the shift is systemic and global. Its potential to exacerbate the prevalence of 'hidden hunger' and obesity is discussed.

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Resource Description

Exposure : ☒

weather or climate related pathway by which climate change affects health

Air Pollution, Ecosystem Changes, Food/Water Security

Air Pollution: Other Air Pollution

Air Pollution (other): CO2

Food/Water Security: Agricultural Productivity, Nutritional Quality

Geographic Feature: ☒

resource focuses on specific type of geography

None or Unspecified

Geographic Location: ☒

resource focuses on specific location

Global or Unspecified

Health Impact:

specification of health effect or disease related to climate change exposure

Diabetes/Obesity, Malnutrition/Undernutrition

Resource Type:

format or standard characteristic of resource

Review

Timescale:

time period studied

Time Scale Unspecified